SUMMER 2014 ENGINEERING DYNAMICS CORPORATION

Technical Newsletter

Available on-line in the EDC Library at www.edccorp.com

HVE Version 10.10 Now Shipping

HVE Version 10.10 update was released on May 23rd. This update shores up some loose ends in the (completely revised) *HVE* Environment Editor, as well as the following new features:

- **Vehicle Light System Data –** Complete light systems, including headlights, brake lights, turn signals and backup lights, have been added to more than 30 vehicles in the EDC Custom Vehicle Database.
- **Extended Messaging –** Error messages now include the vehicle name and wheel location for applicable simulation execution errors.
- **Accident History Basis –** The *SIMON* Accident History output report can now be based on either the Collision Acceleration Threshold (the traditional method) or on the presence of an impact force. This latter method (now the default) provides a perfect match with the impulse start and end times in the Collision Data output report.
- **Vehicle Wizards –** Wizards are now available for all vehicle types. These Wizards are a quick way to create vehicles based on a few traditional measurements, such as weight, weight distribution, overall length and width, wheelbase, front and rear track widths and front and rear overhangs.
- **Vehicle Data for Steer DOF Model –** Default values for steering stop stiffness and steering column inertia have been updated and provide a significant improvement to results using the Steer Degree of Freedom model.

HVE and *HVE-2D* Version 10.10 was shipped to all supported users on May 26th. If you have not received your update, or if you would like installation assistance, give EDC Customer Service a call. We're glad to help!

2015 HVE Forum Set for Austin, Texas

Hang on to your partner and make plans to shuffle down to Austin, Texas, during the week of March 2 – 6, 2015, to attend the *HVE* Forum. It just so happens that the famous South-by-Southwest (SxSW) festival (a combination of music, video and technology) begins the day following the Forum, so you might plan to stay the weekend (or longer!).

The *HVE* Forum provides the ultimate learning experience for both new and experienced users, with over 30 individual workshops to choose from that cover everything from basic concepts to advanced program capabilities.

The *HVE* Forum will be held at the Hilton Garden Inn and Suites, located in the central hub of the city, just off of 6th Street.

Mark your calendar for the week of March 2 – 6, 2015. The registration form, along with workshop schedules and descriptions will soon be available on EDC's website at www.edccorp.com. See page 5 for more information about the 2015 *HVE* Forum.

Technical Session

This Technical Session provides a general back-grounder for vehicle performance testing. Performance testing involves two individual tests:

- Coast-down Testing (deceleration)
- Tractive Effort Testing (wide-open-throttle acceleration)

A coast-down test is used to determine the forces that decelerate a vehicle. After achieving maximum speed, place the vehicle in neutral and coast to a stop. Document the elapsed time at which the vehicle slows over specific speed intervals (e.g., 10 mph).

A tractive effort test is just the opposite. Tractive effort is the term that's used to describe the forces that accelerate a vehicle. A tractive effort test is simply a wide-open throttle acceleration event from a low speed to maximum speed without changing gears (see Discussion); it is typically done in a higher gear. During the test, document the elapsed time at which the vehicle accelerates those same 10 mph speed intervals.

These tests must be performed on a nominally flat and level surface and in the absence of significant wind. To minimize the effect of any grade and/or wind, the tests are usually performed twice, in opposite directions. Not suprisingly, a stretch of road about two miles in length is required. An airport runway is the ideal place to perform these tests.

Vehicle Performance Parameters

The goal of performance testing is to estimate vehicle performance parameters. These include the actual power that's reaching the drive wheels and the vehicle's rolling resistance and aerodynamic drag coefficients. These parameters are amenable to estimation because power is a function of acceleration (slope of the velocity vs. time history), and rolling resistance and aerodynamic drag are functions of velocity and velocity squared, respectively.

Tractive effort and coast-down tests each result in a velocity vs. time relationship. From these results, acceleration vs. time and total force vs. time relationships may also be derived. These relationships are graphed and a regression analysis is performed to determine a 2nd-order polynomial curve fit. Excel is suitable for these tasks.

The magic is in the polynomial coefficients: In the deceleration polynomial for force vs. time, the constant and 1st-order coefficients are related to the tire rolling resistance coefficients, and the 2nd-order coefficient is related to the vehicle drag coefficient. These coefficients may be calculated directly from the regression equations.

To derive the regression equations, consider the forces acting on a vehicle during straight-line acceleration and deceleration,

$$\Sigma F = F_{rr} + F_{aero} + F_{grade} + F_{te},$$

where

ΣF = Sum of all forces acting on vehicle
F_{rr} = rolling resistance force (from tires)
F_{aero} = aerodynamic drag force
F_{grade} = force required to ascend or descend a grade
F_{te} = force from drivetrain (i.e., tractive effort) applied to drive wheels

The rolling resistance force has a constant term, f_o, and a velocity-dependent term, f_1. Thus, rolling resistance is of the form

$$F_{rr} = f_o + f_1 V$$

The aerodynamic drag force is a function of the air density, ρ, the vehicle's projected frontal area, A, the gravitational constant, g, the vehicle's aerodynamic drag coefficient, C_d, and the velocity squared. Thus, it is of the form

$$F_{aero} = \frac{C_d \rho A V^2}{2g}$$

On flat terrain, $F_{grade} = 0$. During a coast-down test, (closed-throttle deceleration in neutral), $F_{te} = 0$. So for a coast-down test,

$$\Sigma F = F_{rr} + F_{aero}$$

$$= f_o + f_1 V + \frac{C_d \rho A V^2}{2g}$$

Of course, Newton's 2nd Law is in effect during the test, so $\Sigma F = ma$. Since we indirectly measured deceleration (change in velocity at 10 mph intervals), we know the acceleration. Thus, we know the decelerating force, ΣF.

An Example

A 2001 Acura 3.2TL was tested as described above. We ran tests in both directions to help reduce any effects due to wind and grade. We then calculated and used the average. The results for the deceleration test from 85 mph to 19 mph are shown in Table 1.(NOTE: All the vehicle data are taken directly from the data in EDC.db.)

Table 1 - Coast-down test results

Time (sec)	Velocity (mph)	Velocity (ft/sec)	Acceleration (mph/sec)	Acceleration (ft/sec²)	F_{rr} + F_{aero} (lb)
2.0	85.0	124.7			
10.0	77.0	112.9	-1.00	-1.47	-175.8
20.0	68.5	100.5	-0.85	-1.25	-149.4
30.0	61.5	90.2	-0.70	-1.03	-123.1
40.0	55.5	81.4	-0.60	-0.88	-105.5
50.0	49.5	72.6	-0.60	-0.88	-105.5
60.0	44.3	64.9	-0.53	-0.77	-92.3
70.0	39.5	57.9	-0.48	-0.70	-83.5
80.0	35.0	51.3	-0.45	-0.66	-79.1
90.0	31.8	46.6	-0.33	-0.48	-57.1
100.0	28.3	41.4	-0.35	-0.51	-61.5
110.0	24.8	36.3	-0.35	-0.51	-61.5
120.0	21.0	30.8	-0.38	-0.55	-65.9
126.0	19.0	27.9	-0.33	-0.49	-58.6

Table 1 also includes the calculated acceleration vs. time (4th and 5th columns) and force vs. time (6th column). For cell, n (where n is the row number), calculate the acceleration as

$$Acc = \frac{V_n - V_{n-1}}{t_n - t_{n-1}} \qquad \text{(mph/sec)}$$

Convert acceleration to ft/sec² by multiplying by 1.467 $^{ft/\sec^2}/_{mph/\sec}$. Then apply Newton's 2nd law to calculate force,

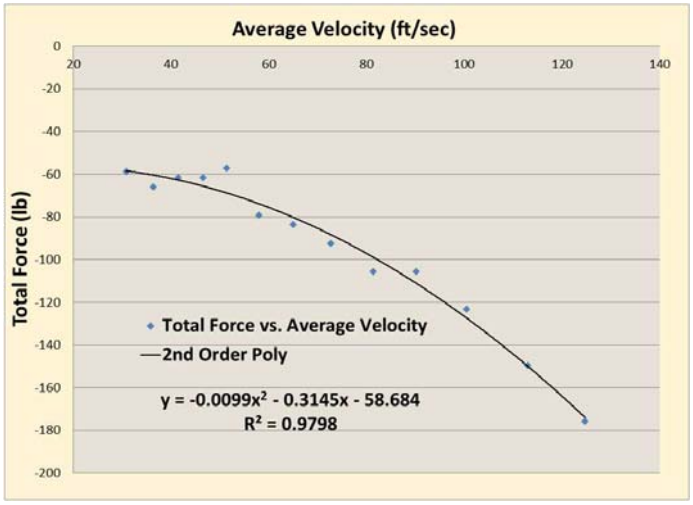
$$\Sigma F = \frac{W}{g} \times Acc \qquad \text{(lb)}$$

Rolling Resistance and Aerodynamic Drag

Note in the development on the previous page, we related forces to velocity. We can easily get this relationship by graphing force vs. velocity and asking Excel for the polynomial curve fit. Figure 1 shows that relationship, along with the 2nd-order polynomial and the resulting correlation coefficient (see Figure 1). The polynomial is

$$\Sigma F = -58.684 - 0.3145V - 0.0099V^2 \qquad \text{(lb)}$$

Figure 1 - Force vs. Velocity from coast-down test



The correlation coefficient is 0.9798, meaning that the calculated relelationship between Force and Velocity accounts for 97.98 percent of the dependence between Force and Velocity. This extremely high correlation is not suprising, since these models for rolling resistance and aerodynamic drag have been well tested.

Based on our model for rolling resistance, we can extract our rolling resistance constant, F_o, from our polynomial. In order to ensure the constant, C_o, can be used on any vehicle, it is normalized by dividing by the vehicle weight (the tire model will multiply F_o by the vertical tire load). Thus, our rolling resistance constant, F_o, is

$$F_0 = \frac{C_0}{W}$$

$$= \frac{58.684}{3860} = 0.015 \frac{lb}{lb}$$

The result, 0.015 lb/lb, falls right in the middle of the expected range, 0.01 to 0.02.

We also divide our polynomial constant, C_1, by the vehicle weight to ensure its general application (the tire model will also multiply F_1 by the vertical tire load). Thus, our velocity-dependent portion, F_1, is

$$F_1 = \frac{C_1}{W}$$

$$= \frac{0.3145}{3860} = 0.00008148 \frac{lb - \sec}{lb - ft}.$$

The aerodynamic drag coefficient, C_d, from our coast-down test is

$$C_d = \frac{F_{Aero}\,2g}{\rho A}$$

$$= \frac{0.0099 \times 2 \times 32.2}{0.075 \times 20.52} = 0.414$$

Again, this value looks quite reasonable for a modern passenger car.

Road Engine Power

Table 2 shows the results for our wide-open throttle acceleration (tractive effort) test from 35 mph to 95 mph at 2 second intervals.

Table 2 - Tractive effort test results

Time (sec)	Velocity (mph)	Acceleration (mph/sec)	Acceleration (ft/sec^2)	F_{te} (lb)	Available Power (HP)
0.0	35.5				
2.0	49.0	6.75	9.90	1186.6	169.0
4.0	61.5	6.25	9.17	1098.7	196.4
6.0	70.0	4.25	6.23	747.1	152.0
8.0	78.5	4.25	6.23	747.1	170.5
10.0	85.5	3.50	5.13	615.3	152.9
12.0	91.5	3.00	4.40	527.4	140.3
14.0	95.0	1.75	2.57	307.6	85.0

In addition to the acceleration and force calculations described earlier and shown in Table 1, we have also calculated available tractive force and power available at the drive wheels to accelerate the vehice. Again, the force is calulated according to Newton's 2nd Law,

$$F_{te} = ma \qquad \text{(lb)}$$

and available power at the drive wheels is

$$Power = \frac{F_{te} \times V \times \xi}{375} \qquad \text{(HP)}$$

where

- a = Acceleration, column 4 (ft/sec^2)
- F_{te} = Tractive force, column 5 (lb)
- V = Velocity, column 2 (mph)
- ξ = Drivetrain inertial factor = 1.1 (see reference [1])

Table 3 - Total engine power from tractive effort testing

Velocity (mph)	Engine Speed (RPM)	$Force_{te}$ (lb)	$Force_{rr}$ (lb)	ΣF (lb)	Total Power (HP)
35.5	5600	1889.8	-69.2	1959.0	203
49.0	4680	1186.6	-87.2	1273.9	182
61.5	5870	1098.7	-110.9	1209.6	216
70.0	4400	747.1	-130.8	877.9	178
78.5	4930	747.1	-153.8	900.9	204
85.5	5370	615.3	-175.0	790.3	194
91.5	5750	527.4	-194.8	722.2	189
95.0	5970	307.6	-207.1	514.8	138

We now have the information required to calculate the total engine power. Recall that the total force is the sum of the rolling resistance, aerodynamic drag, grade and tractive effort. Table 3 shows the pertinent forces (F_{grade} = 0), and the engine speed (see Discussion), calculated as follows:

$$Engine\ Speed = \frac{V_{mph} \times 1467}{SLR} \times \frac{60}{2\pi} \times \eta_{trans} \times \eta_{diff} \text{ (RPM)}$$

where

- SLR = Tire static loaded radius = 1.01 ft
- η_{trans} = Transmission gear ratio (varies between 1st, 2nd and 3rd gears; see Discussion)
- η_{diff} = Differential gear ratio, 4.43:1

And total engine power available at the drive wheels is

$$TotalPower = \frac{(F_{te} \times \xi + F_{rr}) \times V_{mph}}{375} \qquad \text{(HP)}$$

According to the results in Table 3, maximum power is 216 HP at 5870 RPM. This compares reasonably well with the published specifications, 225 HP at 5600 RPM.

Discussion

An error occurred during testing that was not discovered until after testing was complete: During the tractive effort tests, the vehicle's transmission was not locked to a single gear; it was allowed to shift from 1st gear through 3rd gear. Therefore, the power delivered

to the drive wheels changed abruptly at each shift point. The goal of the tractive effort test is to derive a continuous relationship of engine power throughout the engine's normal RPM range. This was not possible. To partially address the issue, the current gear ratio was used for each vehicle speed range. As a result, engine power could be computed only for a limited engine speed range, 4400 to 5970 RPM; see Table 3. By the time this error was discovered, scheduling issues precluded re-testing.

Although these tests can be performed using the vehicle's speedometer and a timer, it is highly recommended that a more sophisticated data acquisition system be employed, especially during coast-down testing, which becomes more sensitive to error as the speed decreases. A VBox [2] system coupled with the vehicle's OBD-II output provide an exceptional data acquisition system for perfomance testing.

References

1. *Mechanics of Vehicles*, Jaroslav J. Taborek, Penton Publishing Co., Cleveland, OH, 1957. (EDC Library Reference No. 1110)

2. VBox (Velocity Box) Vehicle Testing System, RaceLogic, Inc., www.racelogic.co.uk.

Rate This Tech Session

Please go to www.edccorp.com/TechSessionRating to tell us if you liked this Technical Session and to suggest other topics you'd like to see in future technical sessions. Thank you!

2015 *HVE* Forum
March 2 - 6, 2015
Austin, Texas

(continued from page one)

The venue for The 2015 *HVE* Forum is the Hilton Garden Inn, Austin Downtown/Convention Center. This is a great location with lots of nearby restaurants and other attractions - not to mention the location of the South By Southwest (SxSW) festival, which starts on the Saturday following The Forum! For more details about the venue, go to www.hgiaustin.com.

Vehicle Building Class Updated

One of the most popular Forum workshops is Building *HVE* and *HVE-2D* Vehicles. This workshop has been updated to include instruction on adding vehicle light systems and adding textures for vehicle grills, light assemblies, logos, etc. Adding textures is a great way to improve realism. And, of course, having working headlights, running lights, brake lights and turn signals not only improves realism, it also provides an opportunity to illustrate how these driver controls might play a role in a crash sequence.

Call for *HVE* White Papers

All users interested in presenting a technical paper in the *HVE* White Paper session at the 2015 *HVE* Forum are invited to submit an abstract for consideration. *HVE* White Paper topics include *HVE* case studies, novel applications that showcase *HVE*'s capabilities, and any tips and techniques that show other *HVE* users how to take full advantage of *HVE* powerful features. Abstracts are due by October 1, 2014.

Admissibility Workshop

A new Forum workshop on the admissibility of *HVE* results was presented at the 2014 *HVE* Forum. The purpose of this workshop is to provide a clear framework for *HVE* users working to have their *HVE* results admitted in state and federal courts. The focus of this workshop was on admissibility of *HVE* results, not on the more general subject of giving expert testimony. This workshop is receiving a sophomore update for 2015. This workshop is important as well as useful for almost every *HVE* and *HVE-2D* user.

The material covered in the workshop will include:

- Qualifying the Expert
- Education of Attorneys and Judges
- Daubert Challenge of Witness Expertise
- Useful References

This session will be held on Wednesday during the lunch break to allow everyone at the 2014 *HVE* Forum the opportunity to attend. A box lunch will be provided.

Workshop Registration

Workshop schedules, descriptions and registration forms are being fine-tuned and will be available soon to download from the 2015 *HVE* Forum pages at www.edccorp.com/2015HVEForum.

CHP MAIT Teams

MAIT (Multi-disciplinary Accident Investigation Teams) is multi-disciplinary method for investigating car crashes. The original concept of MAIT was pioneered in the early 1960s by Professor Derwyn M. Severy at UCLA's Institute for Transportation and Traffic Engineering. Professor Severy was the first to apply a systems approach to motor vehicle safety, employing the fields of engineering, highway design, human factors and biomechanics. He was probably the first to perform full-scale crash tests in an effort to better understand collision mechanics and how people are injured during a crash.

In 1979, the California Highway Patrol (CHP) applied Professor Severy's multi-disciplinary approach, and formed the CHP MAIT program. The purpose of CHP's MAIT program is to provide detailed analyses for serious crashes throughout the state of California. The results of MAIT reconstructions are used in many ways, including civil and criminal litigation support. In addition to highly trained CHP crash reconstructionists, the MAIT program includes transportation engineers from the California Department of Transportation (Caltrans), automotive engineers and motor carrier specialists. There are currently eight MAIT division offices distributed throughout California.

Since 2005, CHP recontructionists working in the MAIT program have been using *HVE* to perform their in-depth crash investigations. Over 30 CHP reconstructionists have received specialized training on the use of *HVE*.

To support their *HVE* work, CHP reconstructionists perform detailed vehicle and crash site inspections. During vehicle inspections, mechanics are often called in to confirm the integrity of braking and steering systems. Crash sites may be measured using a digital laser scanner or total station. While environment models are currently built using 3-D CAD software, CHP is considering the move to a 3-D modeling package to create realistic 3-D scenes with detailed terrains. Their reconstructions typically use the *EDSMAC4* and *SIMON* physics models.

EDC is very proud of its association with the CHP MAIT program. Through our ongoing technical support program, EDC works directly with MAIT specialists to help them ensure that they achieve the best possible use of *HVE*. It's also a two-way street: CHP MAIT has contributed to the body of reconstruction knowledge for HVE by authoring and presenting a White Paper at the 2008 *HVE* Forum in San Diego (see edccorp.com/library/whitepaper.html to download a copy). We look forward to a long and successful relationship with CHP's MAIT program.

EDC Reconstruction November 10 - 14, 2014 Coral Gables - Miami, FL

EDC Reconstruction is a one-week training seminar that offers an excellent way to learn the inner workings of *EDCRASH*. The course focuses on the physics models, the calculations and the underlying assumptions for each of *EDCRASH*'s five major calculation procedures.

EDC Reconstruction is designed like a college physics course - a combination of morning lectures and afternoon hands-on lab exercises. The fact that this course has been presented annually for over 25 years ensures that students benefit from a well designed and well executed week of instruction.

EDC Reconstruction has been pre-approved for 30 ACTAR CEUs. All course materials, including a handbook, training manual, software and temporary licenses will be provided to each student.

Bring your scientific calculator and laptop computer. Lab exercises include damage-only analysis, collinear collision analysis and oblique collision analysis.

Links to download your course registration form and to make your hotel reservations at the Holiday Inn Coral Gables are available on the EDC Reconstruction page in the Training section of edccorp.com. Contact EDC at 888.768.6216 to sign up today!

Vehiclemetrics Announces Vehicle Database Updates for *HVE* and *HVE-2D*

Vehiclemetrics has announced the release of Version 3 of its database of *HVE* vehicles. The initial release of Version 3 includes an additional 20 vehicles, raising the total number of vehicles in the database to 135.

For more information about the Vehiclemetrics vehicle database, contact Ron Jadischke at 855.966.3357 (toll free) or go to www.vehiclemetrics.com.

HVE and *HVE-2D* F.A.Q.

This section contains answers to frequently asked questions submitted to EDC Technical Support staff by *HVE* and *HVE-2D* users.

Q: While executing a SIMON/DyMESH event, what causes the message, "Event Termination: DyMesh MaxNabor is too small. Too many polygons share a single vertex. The geometry needs to be simplified."

A: This message is displayed when the mesh includes a vertex that is shared by a large number (currently more than 80) polygons. This is almost always caused by a modeling application (e.g., 3D Studio, Rhino...) creating an unnecessarily complex entity. The most likely culprit is a 3-D text object. To solve the problem, return to the modeling application and look for text objects that are needlessly complex. Either remove or simplify these objects.

Q: While executing a SIMON/DyMESH event, what causes the message, "Event Termination: Excessive Suspension Force!"?

A: This message is displayed when the suspension force at a single suspension location (e.g., right front) is greater than the allowable maximum force. The maximum is set to 10 times the total vehicle (vehicle + payload) weight. This maximum value is hard-coded (not user-editable). It is important that the simulation be terminated under this condition because the excessive suspension force would lead to erroneuos results. No suspension is designed to withstand 10 times the total vehicle weight. In the actual event, the suspension was probably damaged. *SIMON* is not designed to simulate such damage. It may be possible to resolve the issue using the Event Set-up, Wheel Damage dialog by assigning a vertical wheel displacement that simulates the collapsed suspension.

Q: What is the max number of entries one can have in a Driver Controls table?

A: All Driver Control tables (Steering, Throttle and Braking) have a fixed length of 50 entries. This limit is hard-coded and cannot be modified by the user.

Q: Is there any way to import data into HVE's Driver Controls table?

A: It is not currently possible to import driver control data directly into HVE's Driver Control tables. This may change in the near future.

Q: Why am I receiving a CRC error when installing HVE? The error states that AVIplay.exe does not match the setup's .CAB file.

A: This is typically a "permissions" issue. Browse to the location of the installation files and right mouse click on the "setup.exe" file. Now select "Run As Administrator." This should resolve your issue.

Q: Can HVE simulate a trailer with 4 axles?

A: *HVE* allows a semi-trailer to have up to 3 axles. Full trailers may have up to six axles (a full trailer with six axles would be comprised of a dolly with three axles followed by a semi-trailer with three axles).

Q: Why do I receive the following error message, "Error transmitting data to physics. Memory file not opened"?

A: This can occur when the physics process (e.g., *EDSMAC4*, *SIMON*, ...) hits an infinite loop and never terminates, causing the memory connection shared between *HVE* and physics to remain open. The solution is to exit out of *HVE* and then open your Task Manager and within the Processes tab terminate any <Physics>.exe process you find. Now when you restart *HVE* everything should work as expected.

Q: When I attempt to modify the viewer option found under the 3-D Edit, Viewer, pull-down menu nothing happens or sometimes the option is even grayed out

A: The 3-D Edit, Viewer option applies only to the 3-D Editor and can be changed only when the 3-D Editor is not in use. To change the Viewer option, first close the 3-D Editor, then change the option.

Q: Why do I receive the following error message when attempting to execute my Event: "Bad Vehicle Mesh Data: Memory Allocation Failed"

A: This message is displayed when a *SIMON/DyMESH* event is executed and the Windows operating system is unable to allocate enough contiguous memory for a vehicle mesh. Each vertex and polygon in the mesh includes numerous parameters that define each vertex or polygon. Thus, a mesh requires a significant amount of available memory. If a mesh has an enormous number of vertices and/or polygons (say, over 100,000), the memory required to store all of the parameters may exceed the computer's available contiguous memory. The only solution is to reduce the number of vertices and polygons.

Visit the Support section of www.edccorp.com to download software updates and to view more FAQ's from the Knowledge Base.

EDC Training Courses

EDC Reconstruction & Simulations

EDC offers excellent one-week courses on the use of the *EDCRASH* reconstruction program and the *EDSMAC*, *EDSMAC4*, *EDSVS* and *EDVTS* simulation programs. The **EDC Reconstruction** and **EDC Simulations** courses are designed to fully investigate the inner workings of these *HVE*-compatible physics programs. Lectures are full of helpful hints gained from years of experience. During the course, students will use the physics programs to complete several lab exercises highlighting the capabilities of each program discussed in the course.

All users of *HVE* and *HVE-2D* agree that these courses are extremely beneficial and challenging. It's the fastest way to learn what you really need to know – how to effectively use the physics programs and get the right results. *Note: These courses focus on the physics programs, not on the HVE user interface.* For courses that focus on using *HVE, HVE-2D* or *HVE-CSI*, check out the *HVE* Forum.

HVE Forum

The ***HVE* Forum** offers numerous workshops designed to help *HVE, HVE-2D* and *HVE-CSI* users improve their modeling and application skills. By participating in workshops, attendees learn new techniques and also how to use the latest advancements in the software. The *HVE* Forum is also a great opportunity to meet other users and expand your network of resources.

Engineering Dynamics Corporation
Training Course Schedule

EDC Reconstruction

Miami, FL . . . . . November 10 - 14, 2014
Los Angeles, CA . . . . . January 2016

EDC Simulations

Los Angeles, CA . . . . . January 19 - 23, 2015
Miami, FL . . . . . November 2015

Theoretical & Applied Vehicle Dynamics

Upon Request

2015 *HVE* FORUM

Austin, TX . . . . . March 2 - 6, 2015

Vehicle Dynamics

The **Theoretical & Applied Vehicle Dynamics** course extends the scope of a general vehicle dynamics discussion by including several direct applications using the *SIMON* vehicle dynamics simulation program within *HVE* and providing a solid theoretical background for such simulations. The course is focused towards engineers and safety researchers with an interest in an understanding of vehicle dynamics and automotive chassis systems development.

Course Registration

To register for a course, download a registration form from the Training page at edccorp.com or contact EDC Customer Service at 888-768-6216 or by email to training@edccorp.com. All courses are eligible for Continuing Education Units and ACTAR credits.

HVE Training Partners

HVE, *HVE-2D* and *HVE-CSI* users looking to improve their skills, but unable to attend one of EDC's regularly scheduled courses, can contact an *HVE* Training Partner for assistance. *HVE* Training Partners are experienced *HVE* and *HVE-2D* users who offer introductory and custom training courses on the use of *HVE*, *HVE-2D*, *HVE-CSI* and *HVE*-compatible physics programs. The list of *HVE* Training Partners may be found at www.edccorp.com.

HVE Discussion Groups

Websites hosted by experienced *HVE* Users offer information about using *HVE* as well as moderated online discussions with other users. Be sure to visit:

AccidentReconOnline.com - Online training courses and also the DiscoverHVE video tutorials and discussion group hosted by Wes Grimes of Collision Engineering Associates.

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